

**REMARKS**

Claims 1-27 are pending in the present application, of which claims 1, 11, and 21 are in independent form. In the present Amendment, claims 1-7, 11 and 21 have been amended.

Claims 1-6 and 11-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,732,170 (Okude) alone, or the hypothetical combination of Okude and U.S. Patent No. 6,336,749 (O'Toole). Claims 7-10, 17-23, and 25-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and U.S. Patent No. 5,372,623 (Ueda). Claim 24 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude, Ueda and O'Toole. Claims 1-3, 5, 11-13 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,729,777 (Kato). Claims 4, 6, 14 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato alone, or the hypothetical combination of Kato and O'Toole. Claims 7-10, 17-23 and 25-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato alone, or the hypothetical combination of Kato and Ueda.

Entry of this Amendment and reconsideration of the rejections is respectfully requested.

**Rejections Under 35 U.S.C. § 103(a)**

Claims 1-6 and 11-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and O'Toole.

As best understood by Applicants, in general, Okude describes a method including heating, via an oxyhydrogen flame, an internal section of a fiber to form an expanded core portion, and then, cutting the fiber in that expanded portion to form a free end. That free end is subsequently fusion-spliced to a free end of another fiber. An arc discharge from a pair of electrodes is then used to heat an internal portion of the newly formed fiber at the fusion splice connection point of the two previously free ends. As conceded by the Examiner, Okude does not describe "heating a free end of the optical fiber."

Moreover, Okude does not render obvious, or provide any motivation for, heating of a free end of a fiber. Further, Okude describes a method of heating an internal section of a fiber. As is known to those of skill in the art, accurately forming an expanded core of a fiber by heating an internal section of the fiber typically requires precise alignment of the fiber for heating, the maintaining of a precise tension of the fiber and the possibility of mode-field distortions.

Claim 1 as amended, of the present application, recites, *inter alia*, a method for "expanding a mode-field diameter . . . comprising the step of heating a free end of a first optical fiber to a temperature within a range of about 500 °C to about 2000 °C, wherein the first optical fiber is adapted to be spliced to a second optical fiber having a larger mode field diameter than the first optical fiber."

"The methods of the invention improve over prior-art methods that comprise first heating an internal section of an optical fiber and then cleaving the fiber at the heat-treated portion." (See last four lines of ¶ [0009] of the specification of the present application as published.)

In addition, by way of the claimed invention, "because the end of the optical fiber to be spliced is heated, rather than an internal section, issues related to exact alignment of the fiber; maintaining a precise tension of the fiber; and issues of mode-field distortions are precluded." (Id. at ¶ [0014].) Thus, the claimed feature of heating a free end of a fiber has certain unexpected benefits over methods that include merely heating an internal portion of a fiber.

Moreover, Okude does not describe or provide motivation for the claimed fiber being "adapted to be spliced to a second optical fiber having a larger mode field diameter than the first optical fiber."

Accordingly, Applicants submit that Okude does not teach, suggest, or provide motivation for the present invention, as set forth in claim 1. Therefore, Applicants submit that amended claim 1 is patentable over Okude, and withdrawal of the rejection to claim 1 under 35 U.S.C. § 103(a) is respectfully requested.

Further, O'Toole does not cure these deficiencies of Okude. As understood by Applicants, O'Toole describes a method of heating, by way of an oxy-hydrogen flame, "fibers in the region of [a] fusion splice to produce diffusion of dopants therein to form a longitudinal diffused region." (See O'Toole at col. 3, lns. 42-45.) O'Toole also describes

heating and "thereby softening the fibers in the region of [a] fusion splice, and axially forcing the spliced fibers towards one another to produce a fattening thereof in the region of the [previously made] fusion splice." (Id. at col. 4, lns. 33-37.) Thus, O'Toole does not appear to Applicants to teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof. Further, O'Toole does not describe or provide motivation for the claimed first optical fiber being "adapted to be spliced to a second optical fiber having a larger mode field diameter than the first optical fiber."

Accordingly, Applicants submit that neither Okude nor O'Toole, either taken alone, or in the hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed invention. Therefore, Applicants submit that claim 1 is patentable over the hypothetical combination of Okude and O'Toole. Withdrawal of the rejections to claim 1 under 35 U.S.C. § 103(a), based on Okude and O'Toole, is respectfully requested.

Claims 1-3, 5, 11-13 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato.

As best understood by Applicants, in general, Kato describes a pre-fusion heating step in where a mode field diameter (MFD) at the adjacent end face of the optical fiber having larger MFD is enlarged by heating a portion including the adjacent end face thereof so as to diffuse a dopant. After the pre-fusion heating step, fusion-splicing of the first and the second optical fibers is performed. Thereafter, during the post-fusion heating step, the dopant is diffused by heating a portion including the fusion-spliced part between the first

and the second optical fibers. (See Kato at Abstract.) In Kato, the end face of the second fiber is "initially small," and subsequently "enlarges rapidly during the post-fusion heating step." (Id. at col. 3, lns. 56-58 and FIG. 1.)

As described above, amended claim 1 of the present application recites the first optical fiber being "adapted to be spliced to a second optical fiber having a larger mode field diameter than the first optical fiber." In contrast, as described above, Kato does not describe such a feature.

Accordingly, Applicants submit that Kato does not teach, suggest, or provide motivation for the present invention, as set forth in claim 1. Therefore, Applicants submit that amended claim 1 is patentable over Kato, and withdrawal of the rejection to claim 1 under 35 U.S.C. § 103(a), based on Kato, is respectfully requested.

Independent amended claim 11 of the present application recites similar limitations to those described above with respect to claim 1 of the present application. Accordingly, Applicants submit that claim 11 is patentable over Okude, O'Toole and/or Kato, either individually, or in combination. Accordingly, withdrawal of the rejections to claim 11 under 35 U.S.C. § 103(a), based on Okude and O'Toole, or Kato, is respectfully requested.

Claims 7-10, 17-23, and 25-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Okude alone, or the hypothetical combination of Okude and Ueda, and Kato alone, or the hypothetical combination of Kato and Ueda. Claims 4, 6, 14 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kato alone, or the hypothetical combination of Kato and O'Toole.

Claim 21 of the present application has been amended to recite features similar to those described above with respect to claims 1 and 11. Accordingly, for reasons described above with respect to the rejections to claims 1 and 11, Applicants submit that claim 21 is patentable over Okude, and Kato, either taken alone, or in combination.

Ueda does not cure these deficiencies of Okude and Kato. As understood by Applicants, Ueda describes a method of forming a glass container by a press-blow system. Ueda appears to describe that the burning of a boron or silicon gas can be used prior to blow molding a jar or container. Thus, Ueda does not appear to Applicants to teach or suggest expanding the mode-field diameter of an optical fiber by heating a free end thereof, nor a first optical fiber being adapted to be spliced to a second optical fiber having a larger mode field diameter than the first optical fiber.

Accordingly, withdrawal of the rejections to claim 21 under 35 U.S.C. § 103(a), based on Okude and/or Ueda and/or Kato, is respectfully requested.

Claims 2-10 each ultimately depend from independent claim 1, claims 12-20 each ultimately depend from claim 11, and claims 22-27 each depend from claim 21.

Accordingly, Applicants submit that claims 2-10, 12-20 and 22-27 are patentable over Okude, O'Toole, Kato and Ueda, either alone, or in combination, for at least the reasons discussed above with respect to the rejections of claims 1, 11 and 21. Therefore, withdrawal of the rejections to claims 2-10, 12-20 and 22-27 under 35 U.S.C. § 103(a) is respectfully requested.

Moreover, Applicants submit that dependent claims 7 (and claims 8-10 depending therefrom) and 17 (and claims 18-20 depending therefrom) are each patentable for additional reasons. For example, claim 7 recites, *inter alia*, heating the free end of the optical fiber by "applying heat generated by a fuel source, wherein the fuel source comprises an organic liquid," while claim 17 recites heating the free end of the optical fiber by "applying heat generated by a fuel source, wherein the fuel source comprises an organic liquid."

As conceded in a previous Office Action, Okude describes the use of an oxyhydrogen fuel, but does not teach or suggest the use of an organic liquid fuel source. While, as understood by Applicants, Ueda describes that methanol may be used during a glass-blowing process, Ueda does not appear to teach or suggest that methanol should be used as part of a fiber optic splicing process.

Further, with regard to the proposed hypothetical combinations of references cited in the Office Action, Applicants note that no motivation to combine these references is presented in the Office Action.

As described in the specification, Applicants have discovered the new and advantageous use of an organic liquid-fueled flame for use in expanding the mode-field diameter of an optical fiber:

An organic-liquid-fueled flame provides a near ideal temperature profile for diffusing the dopants in a dispersion compensating fiber. It causes the dopants to diffuse gradually along the length of fiber in the flame, resulting in a relatively long, gradual expansion of the mode-field diameter over a length of about 1 mm to about 6 mm, more preferably, of about 2 mm to about 4 mm. The gradual mode-field diameter expansion minimizes the splice loss after the heat-treated fiber is spliced. The organic liquid does not require additives and burns clean. The preferred organic liquids, (alcohols with six or fewer carbon atoms and only one hydroxyl group, more preferably, methanol) generate primarily water vapor and CO<sub>2</sub>. Hence, the flame does not leave an organic residue on the fiber.

(See ¶ [0019] of the specification as published.)

Applicants respectfully submit that the glass-blowing methods described by Ueda, either taken alone, or in combination with Okude, Kato and/or O'Toole, do not teach or suggest the claimed use of an organic liquid fuel source to expand the mode field of a fiber.

Therefore, Applicants submit that each of claims 7-10, and 17-20 are patentable over any hypothetical combination of Ueda, Okude, Kato and/or O'Toole for these additional reasons. Withdrawal of the rejections to claims 7-10, and 17-20 under 35 U.S.C. § 103(a) is respectfully requested.

Moreover, Applicants submit that independent claim 21, and claims 22, 23, and 25-27 depending therefrom, are each patentable for additional reasons. As discussed above with respect to claims 7-10, and 17-20, claim 21 recites, *inter alia*, "applying heat to the

optical fiber generated by a fuel source, wherein the fuel source comprises an organic liquid."

As discussed above, Applicants believe that neither Okude nor Ueda nor O'Toole nor Kato, either taken alone, or in any hypothetical combination proposed by the Examiner (assuming such a combination is permissible), teaches, suggests, or provides motivation for the claimed application of heat to an optical fiber generated by a fuel source that includes an organic liquid. Therefore, Applicants submit that claim 21, and claims 22, 23, and 25-27 depending therefrom, are patentable over the hypothetical combination of Okude, Ueda, O'Toole and Kato. Thus, for these additional reasons, withdrawal of the rejections to claims 21-23, and 25-27 under 35 U.S.C. § 103(a) is respectfully requested.

**Summary**

In view of the foregoing, it is respectfully submitted that the claims, as amended, define a novel and patentable invention. Accordingly, this application fully meets the requirements of 35 U.S.C. §§ 102 and 103 and is now in condition for allowance. Entry of this Amendment and reconsideration and favorable action in this regard is therefore earnestly solicited. Authorization is hereby given to charge any deficiencies to deposit account number 501358.

**CONCLUSION**

Applicant's undersigned attorney may be reached by telephone at (973) 597-2500.

All correspondence should continue to be directed to our address listed below.

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